

Multi-Species Chemical Microsensor For Real Time Cryogenic Purge Line Monitoring, Phase II

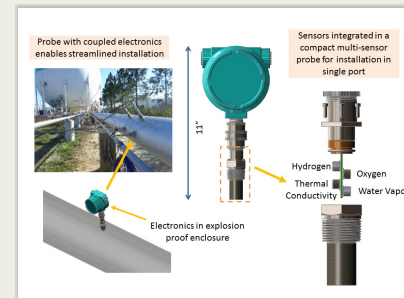
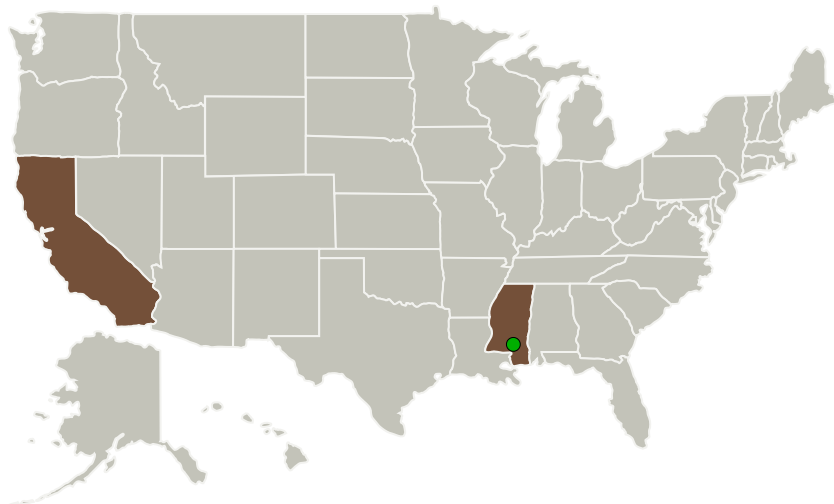
Completed Technology Project (2016 - 2019)



Project Introduction

Makel Engineering, Inc. proposes to develop a miniaturized Multi-Species Chemical Microsensor Instrument suitable for real-time, in situ measurements of hydrogen, oxygen, water vapor and mixture thermal conductivity for monitoring purge effectiveness in cryogenic propellant lines. Helium is a scarce, strategic and non-renewable natural resource. NASA is a major user of helium and significant future cost savings in operations can be realized with improved monitoring of purge activities. Without real time measurement of species being purged from systems, extended purge cycles and excess helium is used to ensure completely purged lines. The proposed sensor system will incorporate the required microsensors in a compact probe to enable multi-parameter monitoring in a single measurement port. The system will be designed to be permanently installed in purge and vent lines at cryogenic propellant storage, transfer, test stand and launch facilities. This program will adapt low cost and low power chemical microsensor technology which was originally developed for leak detection applications and recently been demonstrated in proof of concept cryogenic vent tests at NASA to develop a low cost, robust integrated sensor probe and electronics with data interfaces suitable for real time monitoring and control helium purge sequences to minimize overall helium usage.

Primary U.S. Work Locations and Key Partners



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Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Images	3
Technology Maturity (TRL)	3
Technology Areas	3
Target Destinations	3

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Organizations Performing Work	Role	Type	Location
Makel Engineering, Inc.	Lead Organization	Industry Small Disadvantaged Business (SDB)	Chico, California
● Stennis Space Center(SSC)	Supporting Organization	NASA Center	Stennis Space Center, Mississippi

Primary U.S. Work Locations

California	Mississippi
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Project Transitions

**April 2016:** Project Start**April 2019:** Closed out**Closeout Documentation:**

- Final Summary Chart(<https://techport.nasa.gov/file/139571>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Makel Engineering, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Darby B Makel

Co-Investigator:

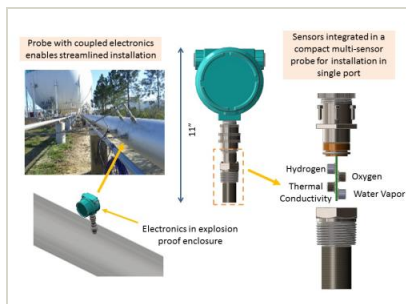
Darby Makel

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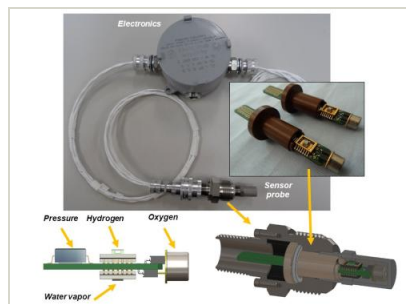


Images

**Briefing Chart Image**

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(<https://techport.nasa.gov/image/131211>)

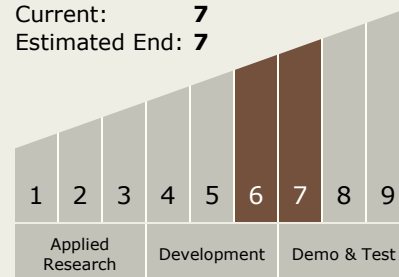
**Final Summary Chart Image**

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(<https://techport.nasa.gov/image/127453>)

Technology Maturity (TRL)

Start: 6
Current: 7
Estimated End: 7



Technology Areas

Primary:

- TX13 Ground, Test, and Surface Systems
 - TX13.1 Infrastructure Optimization
 - TX13.1.3 Commodity Recovery

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System